

DOES DIET COMPOSITION OF RED DEER (*CERVUS ELAPHUS*) DIFFER BETWEEN FENCED AND UNFENCED AREAS?

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ABSTRACT

Botanical composition of red deer diet was studied in fenced and unfenced areas of a forested region in Hungary. We collected faeces samples in spring, summer and autumn (n=20 for each area and period). Analyses were made by microhistological identification of plant epidermis fragments found in the faeces. Browse species dominated the diet of red deer (40-82%) both, in the fenced and unfenced areas throughout the vegetation period. Oak species (*Quercus* spp.) were always the dominant browse species in the diet (11-53%). The consumption of different shrub species was much lower in the fenced than in unfenced area. But, supplementary food appeared in a higher proportion in red deer diet in the game preserve than outside. Generally, maple (*Acer* spp.), elder (*Sambucus nigra*), ash (*Fraxinus* spp.), bramble (*Rubus* spp.), black locust (*Robinia pseudoacacia*), dogwood (*Cornus sanguinea*), and rose (*Rosa* spp.) were consumed among browses. Other forage items as acorn, corn and bark were found in high proportions (0-67%), occasionally. Grasses and forbs did not exceed 10% of the diet in the most cases. Unfenced area seemed to be more favourable for red deer than fenced area from a dietary point of view.

Keywords: diet, faeces analysis, game preserve, red deer, Hungary.

INTRODUCTION

Red deer is a widespread herbivorous game species in Hungary. Stable populations inhabit the diverse habitats of the country from the lowland up to the mountainous areas. The size of the population increased drastically from 1984 (47,500 animals) up to 2000s (approx. 69,000 animals) but the low harvest rate did not change (BURBAITÉ AND CSÁNYI, 2010). In game preserves, an even larger deer density is maintained to ensure hunting possibilities and venison. Nowadays there are 117 game preserves with 7,126 red deer in Hungary (CSÁNYI, 2012). In Europe, approx. 280,000 deer, predominantly red deer and fallow deer (*Dama dama*) were kept in game preserves in 2012 (EFSA, 2012).

The dense deer populations (and other wild ungulates) in the preserves can have significant negative impact on the natural vegetation. Since the regeneration of the browse species is limited, the role of supplementary feeding (hay-silages, grains, special supplements etc.) becomes much more important. Outside the fenced areas, however, forage supply of the natural vegetation determines primarily the diet composition of red deer. The flexibility in feeding behavior of red deer has been reflected in dietary differences in various natural environments in Europe (HEARNEY AND JENNINGS, 1983; HOMOLKA, 1990; BRUINDERINK AND HAZEBROEK, 1995; MATTIELLO ET AL., 1996; GEBERT and VERHEYDEN-TIXIER, 2001; MÁTRAI ET AL., 2004). Studies have shown exceptional adaptation of this species to the changes in food availability (HOFMANN, 1985).

Actual knowledge of diet composition of red deer is mainly based on studies of free-ranging deer. However, information on foraging habits of fenced populations is also important for wildlife management purposes. But until this time, few specific studies have compared the diet composition of deer living in fenced and unfenced areas. Hence, we

aimed to compare how diet composition differs inside and outside game preserve during the vegetation period.

MATERIAL AND METHOD

Study area

We conducted our study in a fenced area of 700 ha inhabited by 130 red deer (NGMD, 2012) and a neighbouring unfenced area located in north-central Hungary (Gyarmatpuszta, Bajna Forestry, Park Forest Joint-Stock Company of Pilis). The topography is characterized by gently rolling hills of dolomite and limestone with an average elevation of 300 m. On the lower areas, meadows and agricultural fields of alfalfa (*Medicago sativa*) and cereals, mainly oats (*Secale* spp.) and barley (*Hordeum vulgare*) occur in the valleys. Fishponds also occur among the hills. Precipitation is 345 mm in the vegetation period, and the annual mean temperature is 9,5 °C. The dominant tree species are oak, maple, hornbeam (*Carpinus betulus*), ash and lime (*Tilia* spp.). Dominant shrubs are maple, elder, privet (*Ligustrum vulgare*) and dogwood. However, understory is very scarce in the preserve. In the fenced area, barleycorn, maize grains, pomace, and granules made for red deer are fed. Populations of roe deer (*Capreolus capreolus*), mouflon (*Ovis musimon*) and wild boar (*Sus scrofa*) are also present in the study area.

We estimated the botanical composition of red deer diet individually by microhistological analysis of faeces (HOLECHEK, 1982; MÁTRAI AND KABAI, 1989) collected in spring (23.05.), summer (01.08.), and autumn (29.10.) 2012 in the fenced and unfenced areas (n=20 in each area and date). We boiled a small quantity of faeces by 40% nitric acid then mounted the fragments with 0,2% Toluidine-Blue. We identified 100 epidermis fragments under a microscope at 260X magnification using a reference collection of plant species (MÁTRAI ET AL., 1986). The proportion of diet components was estimated from the number of fragments for a particular forage species or group relative to the total number of fragments. The distinguished categories were as follow: oak (dominant tree species); other browses (leaves, stems of other browse species); bark; forbs (dicotyledonous herbs), grasses (grass and grasslike species), seeds (acorn and wild fruits and seeds); supplementary feed (pomace, barleycorn, maize grains and granules).

We evaluated the differences among the proportion of forage groups in a given period and site by Kruskal-Wallis-tests with Dunn's multiple comparison tests. We compared the proportion of different food components within and outside the preserve by *t*-tests or Mann-Whitney U-tests depending on the normality of the data. We used SPSS 10.0 software package to perform all analysis.

RESULTS

We revealed significant differences among the proportion of different food components in each period in both areas ($P < 0,001$). (Figure 1.). The diet of red deer was dominated by browses (40-82%) all over the vegetation period, both inside and outside. Oak was the most common forage item (11-53%) among browses. Grasses and forbs did not exceed 10% of the diet in most cases, except grasses in spring in the preserve ($31 \pm 22,3\%$) and in autumn outside ($30 \pm 16,4\%$). Acorn ($< 10\%$) was frequent food component inside in autumn (n=18) and outside in summer (n=17). Similarly, bark remains were found in the diet in low proportion ($< 10\%$), but frequently in both areas in spring (n=18) and outside in summer (n=12).

The consumption of different shrub species was much lower in the fenced than in unfenced area. Oak and grasses or oak and corn made up the mass of the diet (70-74%) in the fenced area; meanwhile oak, maple, elder, ash, alfalfa, acorn and corn (70-84%) did it in the unfenced area. But in a few deer samples in the unfenced area a single forage item dominated the diet. These were privet, rose (*Rosa* spp.), ash, dogwood, black locust (*Robinia pseudoacacia*), and bramble (*Rubus* spp.) among browses (15-86%); alfalfa, marijuana (*Cannabis sativa*), purple loosestrife (*Lythrum salicaria*), milk-vetch (*Astragalus* spp.) among forbs (15-62%) and acorn (21-61%).

In the game preserve supplementary food appeared in a higher proportion in red deer diet than outside. This consumption was dominated by corn in fenced area in summer ($21 \pm 33\%$) and autumn ($35 \pm 14,8\%$). Granules were found only in two samples in summer (30 and 54%).

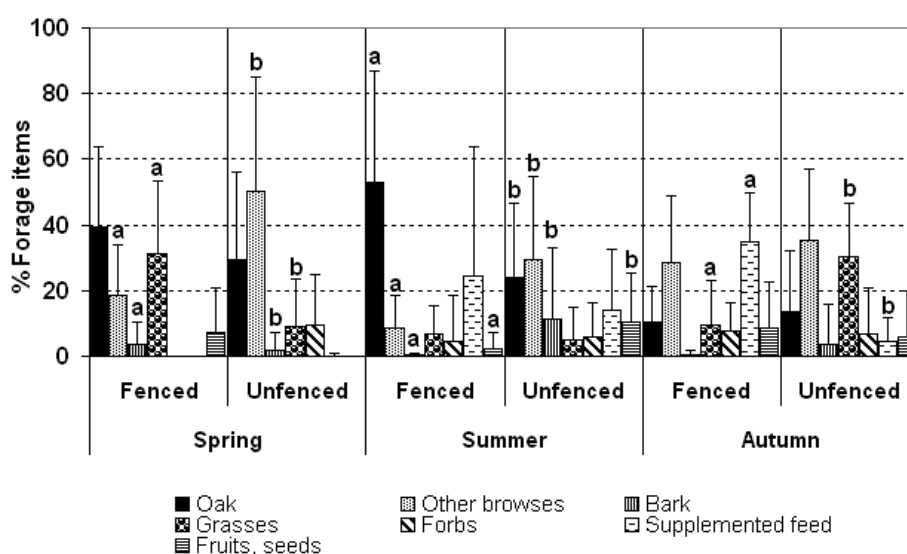


Figure 1. Mean proportion of different forage items (\pm SD) in red deer diet in fenced and unfenced areas during the vegetation period, Gyarmatpuszta (Hungary) 2012.

Different letters indicate significant difference ($P < 0,05$) between the diet composition of fenced and unfenced deer within seasons.

DISCUSSION AND CONCLUSIONS

Diet of red deer living in fenced area can differ from that of the free-living animals even within the same forested region. For wildlife managers the knowledge of the quantitative characteristics of the deer diet in fenced and unfenced areas is essential. In natural environment the browse-dominated deer diet is well-known (MÁTRAI AND KABAI, 1989; CHEN ET AL., 1998; MÁTRAI ET AL., 2004; PROKEŠOVÁ, 2004). In this study we described the diet of red deer in a forested environment in a game preserve and in the neighbouring area. We found that red deer consumed primarily browses in both areas during the whole vegetation period, but there were some distinct differences in the diet between the two sites. Many deer consumed oak and other bark in both areas in spring and summer. However, we revealed only a limited consumption of other browse species within the preserve, but not in the unfenced area. According to this, we can suppose that fallen leaves of oak could be a primary food source for red deer. Bark and fallen leaves as alternative diet components appear in the diet when resources are restricted (MAKINO,

1996 in BORKOWSKI AND FURUBAYASHI, 1998; TAKAHASHI AND KAJI, 2001). Our field observations support that the understory food supply is very scarce in the preserve resulting in foraging from the litter. Deer could find richer and more diverse vegetation outside than inside the fences, so they could select browses of higher nutritional values, such as elder and black locust (MÁTRAI, 1987; GÁBORČIK ET AL., 1999; MÁTRAI ET AL., 2002). More diverse species composition of the diet in the unfenced area reflects this assumption. In the fenced area deer diet was composed of oak and grasses or oak and corn that made up three quarter of the diet. In contrast, that large proportion was composed of 4 to 6 forage items out of the preserve.

Due to the low availability of natural food supplies supplementary feed became important food item in the preserve. Corn dominated this forage group, while we found the rare and low consumption of maize grains (<1%) and granules (<5%) within the fences. It shows that deer probably could not get them, due to the interspecific competition with wild boar. The presence of granules only in two faeces samples (30-54%) can confirm this theory. We suppose that when red deer can access to the supplemented seeds, they do consume them.

As a conclusion, game preserve can be a less optimal area for red deer from a dietary aspect, which strongly influences its food selection and diet composition.

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